

Original Paper

Relationships between Environmental Perceptions and Walking Exercise Behavior among Older People in Different Residential Areas

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Abstract

We aimed to clarify relationships of walking activities to physical and social environments among older people and improve interventions with community characteristics and the environment in mind. An anonymous self-administered questionnaire survey was conducted with 681 participants at the College for the Aged sponsored by Okayama Prefecture Federation of Senior Citizens Clubs. Included in the survey were demographic characteristics, stages of walking behavior and perceived physical and social environments. Participants were divided into the urban and semi-mountainous regions, and also divided by stage of walking behavior into implementing and non-implementing groups. The Mann-Whitney U test was used to examine the results. Out of 610 returned questionnaires (response rate 89.6%), 338 completed questionnaires were analyzed. As a result, older people in the urban region perceived physical environment to be significantly higher than those in the semi-mountainous region. The implementing group perceived social environment to be significantly higher than the non-implementing group. In addition, for the semi-mountainous region, the implementing group perceived physical environment to be higher than the non-implementing group. These findings suggest that in order to promote walking activity it is effective to intervene in perceived physical and social environments in the semi-mountainous region, and the perceived social environment in the urban region.

1. Introduction

Health Japan 21 (the 2nd term) started as a national movement in 2013 to extend healthy life expectancy and reduce health disparities. It recommends that local governments, companies and civil organizations endeavor to promote daily activity and exercise, with specific targets set in a variety of health indices, for example, to increase the target daily number of steps for over 65 year old males to 7,000 steps [1, 2].

A number of studies have already provided evidence of relationships of physical activity to elderly health status. For example, there is evidence that daily activity is effective in reducing the number of bedridden

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older persons. Based on this kind of evidence, infrastructure is being laid down to provide a good physical environment to promote physical activities including walking [2]. In addition, the Ministry of Health, Labour and Welfare is subsidizing clubs for senior citizen activities through local governments to improve social environment and promote older people's meaning for living [3].

In this background, Okayama Prefecture Association of Clubs for Senior Citizens has made activities to promote walking exercise among older people since 2000, but with little effect [4]. Okayama Prefecture, located in the Chugoku District, has a population of approximately 1.93 million (930,000 males, 1 million females), 530,000 people over 65 years (28%), as of Oct. 1, 2013 [5]. Twenty-two of 27 municipalities are located in the semi-mountainous area, covering an area of 5,353 km², accounting for 75% of the entire prefecture. The aging rate of 28.5% there is much higher compared to 19.6% for that of the other municipalities. The aging phenomenon in the semi-mountainous area is now a serious problem [6]. Therefore, promotion of physical activities and exercise in that area is an urgent need. The semi-mountainous area has rather many slopes, little farmland and places of residence; most of the area is forest land. As administrative services and conveniences in daily lives are not readily available, it is necessary to figure out good ways and means to promote walking exercise in the area [7].

Studies on physical activity and environment have reported relationships between physical activity and physical environment in neighborhoods, mainly in Western countries, since about 2000 [8-11], with the focus on close proximity to the destination, mixed use of land (many shops and public services to walk to), road connections (high density of crossroads making it easy to take the shortest route to the destination), proximity to a park or sports facility, infrastructure for elderly walkers, and physical environment (e.g. scenery). For example, the high density of residences, good access to various destinations and scenery were found to have an effect on physical activities [12]. It was also reported that perceived environment is associated with physical activities [13-16]. However, the environment has two aspects: physical environment and social environment [17], and in recent years attention has been paid to a need for an integration of the two aspects. Studies on integration of the physical environments and social environments have reported that environmental factors, self-efficacy and social support had an effect on physical activities [16-19], and also that self-efficacy, perceived physical environment and perceived social environment were associated with walking activities [20]. However, in taking measures to promote physical activities, very few studies have addressed interventions in careful consideration to community characteristics and the environment so far [21].

We aimed, therefore, to clarify relationships of walking activities to physical and social environments among older people and improve interventions with community characteristics and the environment in mind.

2. Methods

2.1. Subjects

The subjects were 681 older people who participated in the College for the Aged program sponsored by Okayama Prefecture Federation of Senior Citizens Clubs.

2.2. Survey

An anonymous self-administered questionnaire survey was conducted at four sites of the College for the Aged (two in the urban and two in the semi-mountainous regions in September, 2012). Questionnaires were distributed to a convenient sample and collected at each site. Older people of 60 years or over account for 31.1% of the population of the urban region, and account for 38.9% of that of the semi-mountainous region. Those who belonged to the senior citizens club were 18.8% in the urban region and 38.9% in the semi-mountainous region. (March 31, 2012) [4].

2.3. Contents of survey

Prior to the survey it was explained to the potential participants that 'walking' meant walking for some

time, including strolling and walking to and back from work or shopping, and that ‘regularly’ meant twice or more times per week and walking 20-30 minutes at a time.

2.3.1. Demographic characteristics

Included were age, gender, family structure, occupation, education, perceived health status, and economic comfort.

2.3.2. Stages of walking behavior

Yamawaki et al.’s change and self-efficacy scales for walking behavior [22] were used to assess the stage of each participant. The reliability of the scale was confirmed by Yamawaki et al. The stages in the scale are as follows: Precontemplation (not walking now, nor any intention to walk in future); Contemplation (not walking now, but thinking of beginning to walk in the near future or within 6 months); Preparation (walking now, but not regularly); Action (walking regularly, but still within 6 months from the start); and Maintenance (walking regularly, for more than 6 months). Participants were asked to choose one stage that applied to them.

2.3.3. Perceived physical environment

Perceived physical environment was assessed using four items based on Itakura et al. [13]. The items and statements used were as follows: (accessibility) “I have many places suitable for walking and facilities such as public walks and parks in the neighborhood.” (safety) “I can enjoy walking in a safe, well-maintained environment with sufficient lighting, hiking and walking trails and little traffic.” (scenery) “I can enjoy beautiful scenery while walking in the neighborhood.” (role model) “I can see many people walking in the neighborhood”.

Participants were asked to rate the above items on a 4-point scale which ranged from 1 (I don’t agree at all) to 4 (I quite agree) with higher scores indicating a higher perceived physical environment.

2.3.4. Perceived social environment

Perceived social environment was assessed using five items based on Itakura et al. [23]. The five items used were as follows: (advice/instruction) “My family and friends kindly give me advice and instruction as to how to do walking exercise.” (understanding/sympathy) “My family and friends understand I spend some time walking.” (encouragement/reinforcement) “My family and friends encourage and support me to do walking exercise.” (joint implementation) “My family and friends walk together with me.” (compliment/appreciation) “My family and friends compliment me for doing walking exercise.”

Participants were asked to rate each item on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) with higher scores indicative of higher perceived social environment.

2.4. Ethical considerations

The purpose of the study, subjects and ethical considerations were explained to the steering committee of Okayama Prefecture Federation of Senior Citizens Clubs, who gave consent. It was also explained verbally to the potential subjects that participation in the study was voluntary; that data was used for that purpose only; that anonymity and confidentiality were guaranteed; that returned questionnaires would be discarded with a shredder; and that findings would be presented at conferences or published. Consent was implied by the return of the questionnaire. The study was approved by the research ethics committee of Okayama Prefectural University in July, 2012.

2.5. Analytical methods

Places of residence were divided into the urban region (Okayama City and Kurashiki City) and the semi-mountainous region (Takahashi City and Tsuyama City). Participants were divided by stages into the non-implementing group and the implementing group, including only those who regularly do walking exercise.

χ^2 test and Student’s *t* test were used to examine relationships between places of residence and demographic characteristics. The Mann-Whitney U test was also used to examine the relationships between places of residence and perceived physical and social environments and the relationships of the non-implementing

and implementing groups and perceived physical and social environments.

All statistical analyses were performed using IBM SPSS Statistics version 20.0.

3. Results

Out of 610 questionnaires returned (89.6%), 338 were completed (response rate, 55.4%). There were 197 participants (58.3%) from the urban region, and 141 (36.3%) from the semi-mountainous region, with 184 males (54.4%) and 154 females (45.6%). The average age was 74.6 ± 5.1 .

3.1. Demographic characteristics and stages (Table1)

The average age of the participants from the urban region was significantly higher than that of the participants from the semi-mountainous region ($p < .01$). The number of working participants was significantly larger in the semi-mountainous area than in the urban area ($p < .001$).

In both regions there were a few more males than females; most of the family structures were solitary or by couple; most of them graduated from a junior high school under the prewar education system or a high school under the new educational system; and most of them perceived themselves to be healthy. More people lived comfortably in the urban region than in the semi-mountainous region. In the above items there were no significant differences between both regions.

In both regions the largest number of participants were at the preparation stage, followed by the maintenance stage. In the urban region the implementing group included 65 (33.0%) and the non-implementing group 132 (67.0%), while the implementing group included 40 (28.4%) and the non-

Table 1 Demographic characteristics and stages of walking behavior (n=338)

		urban (n=197)	semi-mountainous (n=141)
age (years)	60-74	111 (56.3)	57 (40.4) **
	75 +	86 (43.7)	84 (59.6)
	mean \pm SD	74.2 \pm 5.1	75.2 \pm 5.0
gender	male	106 (53.8)	78 (55.3)
	female	91 (46.2)	63 (44.7)
family structure	living alone / husband and wife	107 (54.3)	85 (60.3)
	living with children / others	90 (45.7)	56 (39.7)
occupation	an occupation	20 (10.2)	33 (23.4) ***
	no occupation	177 (89.8)	108 (76.6)
education	junior high school / high school	131 (66.5)	97 (68.8)
	old-system high school	66 (33.5)	44 (31.2)
perceived health status	not healthy / not very healthy	46 (23.4)	31 (22.0)
	rather healthy / very healthy	151 (76.6)	110 (78.0)
economic comfort	none / not so much	86 (43.7)	74 (52.5)
	so-so / much	111 (56.3)	67 (47.5)
stages of walking behavior	precontemplation	28 (14.2)	22 (15.6)
	contemplation	28 (14.2)	19 (13.5)
	preparation	74 (37.6)	54 (38.3)
	action	2 (1.0)	6 (4.3)
	maintenance	65 (33.0)	40 (28.4)

n (%)

χ^2 test, ** $p < .01$, *** $p < .001$

implementing group 101 (71.6%) in the semi-mountainous region. χ^2 test revealed no significant difference between both regions.

3.2. Comparison of scores for perceived physical and social environments between two regions (Table2)

Regarding the perceived physical environment, people from the urban region scored significantly higher in accessibility ($p < .001$), safety ($p < .05$) and role model ($p < .001$) than those from the semi-mountainous region. However, there was no difference in scenery between the regions.

Regarding perceived social environment, there was no significant difference in any items between the regions.

Table 2 Comparisons of scores for perceived physical and social environment between two regions (n=338)

Factors	urban (n=197)	semi-mountainous (n=141)
perceived physical environment		
accessibility	2.69 \pm 0.88	2.30 \pm 0.98 ***
safety	2.60 \pm 0.79	2.38 \pm 0.94 *
scenery	2.67 \pm 0.79	2.50 \pm 0.89
role model	3.12 \pm 0.71	2.62 \pm 0.88 ***
perceived social environment		
advice / instruction	2.32 \pm 1.10	2.12 \pm 1.12
understanding / sympathy	3.56 \pm 0.91	3.42 \pm 1.10
encouragement / reinforcement	3.12 \pm 1.10	3.11 \pm 1.13
joint implementation	2.48 \pm 1.15	2.40 \pm 1.22
compliment / appreciation	2.77 \pm 1.14	2.75 \pm 1.16

Data are mean \pm SD.

Mann-Whitney U test, * $p < .05$, *** $p < .001$

3.3. The relationships of implementing walking exercise to perceived physical and social environments (Table 3, 4)

Regarding perceived social environment, the implementing group scored significantly higher in understanding/sympathy ($p < .01$), encouragement/reinforcement ($p < .05$) and compliment/appreciation ($p < .01$) than the non-implementing group in the urban region. There was no difference in perceived physical environment between the groups.

In the semi-mountainous region, on the other hand, the implementing group scored significantly higher in accessibility ($p < .05$) and safety ($p < .01$) of perceived physical environment, and in advice/ instruction ($p < .05$), understanding/sympathy ($p < .01$), encouragement/reinforcement ($p < .01$), joint implementation ($p < .01$) and compliment/appreciation ($p < .05$) of perceived social environment than the non-implementing group.

4. Discussion

By examining the relationships between walking activities and the physical and social environments among older people living in the urban and semi-mountainous regions, we tried to improve interventions with community and environmental characteristics in mind.

More male participants returned the questionnaire than female participants. Moreover, the participants from the urban region were younger than those from the semi-mountainous region. There were more participants without occupation in the urban region and the number of participants who walked regularly was larger in the urban region. In the semi-mountainous region many people are engaged in agriculture and forestry and as they do not work under an age-limited retirement system, they can work for as long

Table 3 The relationships of implementing walking exercise to perceived physical and social environments in urban areas (n=197)

Factors	non-implementing group (n=132)	implementing group (n=65)
perceived physical environment		
accessibility	2.74 ± 0.87	2.58 ± 0.88
safety	2.64 ± 0.77	2.52 ± 0.83
scenery	2.68 ± 0.78	2.65 ± 0.82
role model	3.07 ± 0.70	3.22 ± 0.72
perceived social environment		
advice / instruction	2.28 ± 1.01	2.40 ± 1.27
understanding / sympathy	3.45 ± 0.87	3.77 ± 0.96 **
encouragement / reinforcement	2.99 ± 1.07	3.38 ± 1.11 *
joint implementation	2.42 ± 1.07	2.60 ± 1.31
compliment / appreciation	2.58 ± 1.06	3.17 ± 1.21 **

Data are mean ± SD.

Mann-Whitney U test, * $p < .05$, ** $p < .01$

groups: non-implementing group (precontemplation, contemplation, preparation, action), implementing group (maintenance)

Table 4 The relationships of implementing walking exercise to perceived physical and social environments in semi-mountainous areas (n=141)

Factors	non-implementing group (n=101)	implementing group (n=40)
perceived physical environment		
accessibility	2.17 ± 0.94	2.63 ± 1.00 *
safety	2.26 ± 0.96	2.70 ± 0.82 **
scenery	2.43 ± 0.90	2.70 ± 0.85
role model	2.61 ± 0.92	2.65 ± 0.80
perceived social environment		
advice / instruction	1.97 ± 1.06	2.50 ± 1.20 *
understanding / sympathy	3.22 ± 1.18	3.93 ± 0.66 **
encouragement / reinforcement	2.91 ± 1.15	3.60 ± 0.90 **
joint implementation	2.19 ± 1.15	2.93 ± 1.25 **
compliment / appreciation	2.63 ± 1.17	3.05 ± 1.08 *

Data are mean ± SD.

Mann-Whitney U test, * $p < .05$, ** $p < .01$

groups: non-implementing group (precontemplation, contemplation, preparation, action), implementing group (maintenance)

as they intend to. For the senior citizens club to promote walking exercise, it may be necessary to keep in mind the difference in distribution of age between the regions and review the type of instruction such as the intensity of walking.

In regards to the stages, the participants who perceived themselves to be at the preparation stage were the largest in number, accounting for approximately 40%. This was consistent with the results of a previous study of older people living in the semi-mountainous region [20]. Furthermore, over 30% of the participants perceived themselves to be at the maintenance stage and do walking exercise regularly. The number of them was larger than that of those at the precontemplation and contemplation stages. Given that previous

studies of older people living in the semi-mountainous community [20] and those living at home [24] reported that those who were at the precontemplation and contemplation stages and did not do walking exercise were larger in number than those at the other stages, the participants in this study can be said to include more older people who do walking exercise regularly.

Next, in regards to the relationships of places of residence to perceived physical and social environments, older people in the urban region perceived accessibility, safety and role model to be significantly higher than those in the semi-mountainous region. This result may show that the physical environment of the urban region is kept in better condition than in the semi-mountainous region. On the other hand, as scenery is the only strong point of the semi-mountainous region [20], there seemed to be no significant difference.

According to a previous study [11], there are relationships between physical activity and environments. Therefore this study showed a similar trend. Moreover, we discussed the relationships between the implementing and non-implementing groups and perceived physical and social environments separately by regions. In the semi-mountainous region the implementing group perceived accessibility and safety of the physical environment to be significantly higher than the non-implementing group. In the rural region, however, there was no significant difference. This result shows that in spite of the unprepared physical environment, the implementing group perceived the physical environment positively in the semi-mountainous region. Although it is not clear whether there is any cause-and-effect relationship between these, we cannot deny that accessibility and safety may be associated with the fact that the group can continue walking regularly. Therefore, the first thing we can do to promote walking would be to provide interventions to enhance residents' perceptions of accessibility and safety, for example, distributing or setting up maps showing public walks, trails, parks, sidewalks, etc. To do this, it would be necessary to make a policy recommendation to the local government.

In regards to the perceived social environment, the implementing group from the urban region perceived understanding/sympathy, encouragement/reinforcement, compliment/appreciation to be significantly higher than the non-implementing group. Whereas in the semi-mountainous region the implementing group perceived all items to be significantly higher than the non-implementing group. In both regions the implementing group appreciated support from their family and friends, which may help lead to more walking exercise. Therefore, interventions to enhance perceived support from the family and friends among the non-implementing group are likely to engage them in regular walking exercise.

In order to promote walking exercise in the urban region, it would be effective to encourage the family and friends to express understanding/sympathy, encouragement/reinforcement and compliment/appreciation. On the other hand in semi-mountainous region, it may be necessary to intervene in all components of perceived social environment and as well as in accessibility and safety to promote walking exercise.

There were several study limitations. First, the response rate was very low and the number of the questionnaires analyzed was small. To increase response rates, it is better to make the questions used easier to answer and increase response rates. Next, more men participated in the study than women. However, in the population of 60 or over, the number of men is less than women [25], as it is in the membership of the Okayama Prefecture Senior Citizens Club (men 40% and women 60%, as of March 2014). The sample used in this study, therefore, cannot be said to be representative of the general elderly population, and our findings are not generalizable. In addition, it would be better to use GIS (Geographic Information System) as an objective measure as well as previous studies [8, 9] because this study was only using subjective measures. Finally, since this was a cross-sectional study, we could not refer to the cause-and-effect relationship between walking exercise and perceived physical and social environments. In future research causal relationships need to be focused on in an intervention study, although our findings are of some use in that the data were collected at four different sites in the prefecture and analyzed by region.

5. Conclusion

Older people living in the semi-mountainous region perceived physical environment to be higher compared to those in the urban region. However, the implementing group perceived physical environment to be higher than the non-implementing group. Moreover, the implementing group perceived social environment to be higher both in the urban and semi-mountainous regions. In order to promote walking exercise among older people, it is likely to be effective to intervene in a perceived walking environment and support from family and friends in the semi-mountainous region, and support from family and friends in the urban region.

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